Through major partnerships with U.S. industry, the Laboratory is acquiring mission-critical capabilities such as the Accelerated Strategic Computing Initiative and constructing the National Ignition Facility. We obtain other critical capabilities needed at the Laboratory through partnerships, and we create new opportunities for U.S. industry by "spinning off" technologies.

New Capabilities through Partnerships

A melting operator performs a visual inspection of the continuous melting laser glass as it comes out of the Lehr oven at Hoya Corporation. Each laser glass slab is carefully fine annealed and extensively tested and inspected. The glass produced by a continuous melting system has successfully achieved the stringent specifications required for NIF.

Technology Development with Industry

Livermore's interactions with U.S. industry are exemplified by our 88 active licensing agreements, 47 cooperative research and development agreements, 175 reported inventions, 299 industrial work-for-others agreements, 112 patent applications, and 95 issued patents in FY 2000.

For example, we are partnering with BioLuminate Inc. to develop Smart Probe, a tool for detecting early breast cancer with accuracy levels comparable to biopsies but without removing tissue.

In a licensing agreement, MiniMed Inc. is using a novel Livermore technology to develop a noninvasive glucose measurement for continuously indicating the sugar level in diabetic patients. When used with an implanted insulin pump, the two devices would essentially become an artificial pancreas.

In another licensing agreement with two companies, FlexICs Inc. and Rolltronics, a Livermore laser-based technique is being developed for producing plastic flat-panel displays. Plastic displays are rugged, compact, and lightweight, and they are cheaper to produce than the glass displays that they would replace.

We are one of the founding partners (with Sandia National Laboratories, the City of Livermore, and private-sector sponsors) of the Tri-Valley Technology Enterprise Center (TTEC)—a regional business incubator under the aegis of the Tri-Valley Business Council. TTEC is providing support for start-up high-tech companies.

Laser Glass Production for NIF

The construction of the National Ignition Facility (NIF) at Livermore relies on hundreds of partnerships to develop the required technologies. For example, obtaining large quantities of quality glass was one of the project's top technological and manufacturing challenges. By the end of January 2001, our commercial vendors, Schott Glass Technologies and Hoya Corporation, had produced more than 1,000 laser glass slabs for NIF, roughly half of the total laser glass slabs needed.

Research and development spearheaded by Livermore and the two glass manufacturers made production possible. Both Schott and Hoya demonstrated a process to ensure economical production of high-optical-quality, neodymium-doped, phosphate laser glass at a rate

The LaserShot[SM] Peening system won a 2000 Federal Laboratory Consortium Award of Excellence in Technology Transfer for transferring technology to the commercial marketplace. Because laser peening is more effective than other strengthening methods, parts such as aircraft engine fan blades and gears can be made thinner and thus lighter. In addition, laser-peened products will probably need less energy to operate.

20 times faster than could be achieved using existing technology. They carried out cooperative research specifically aimed at reducing moisture contamination so that the glass would meet the stringent specifications required for NIF.

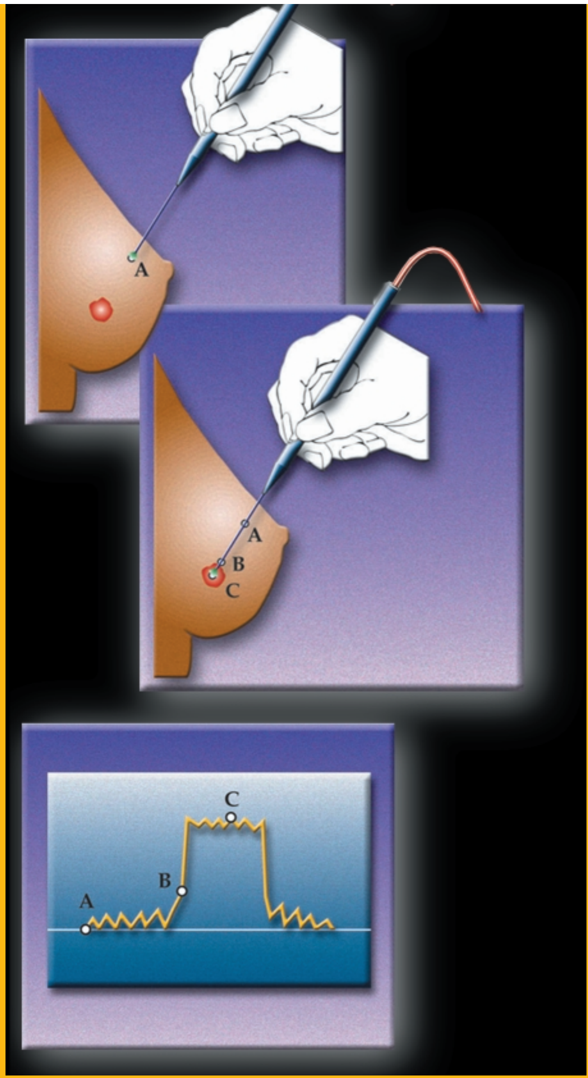
Preparing to Demonstrate EUV Lithography

Teamed together as a Virtual National Laboratory (VNL), researchers from Lawrence Livermore, Sandia, and Lawrence Berkeley national laboratories are working with an industrial consortium to develop next-generation technology for semiconductor manufacturing. The team is pursuing extreme-ultraviolet (EUV) lithography as a means for etching ultrathin patterns into silicon chips. The research and development effort by VNL is a $250-million, multiyear cooperative research and development agreement (CRADA) with the EUV LLC (Limited Liability Corporation) consortium consisting of Intel, AMD, Motorola, Micron, and Infineon.

Efforts by VNL have focused on integrating the necessary technologies into an engineering test stand that will function as a prototype EUV lithography system. Livermore leads the efforts in the test stand's optical systems and components, thin films, masks, and submicrometer metrology. A goal for early 2001 is to use the test stand to print patterns onto silicon chips with features as small as 0.10 micrometer, or about a thousandth the width of a human hair. Through further technological improvements, engineers expect to shrink features to less than 0.03 micrometer, making it possible to manufacture the much smaller, more powerful chips.

PEREGRINE Goes Commercial

Livermore's PEREGRINE technology is a revolutionary tool for analyzing and planning radiation treatment for cancer patients. The NOMOS Corporation has been licensed by Livermore to use the PEREGRINE technology and recently was granted clearance by the U.S. Food and Drug Administration to produce and market PEREGRINE systems to the medical community. Compared with other dose-calculation methods in current use, PEREGRINE more exactly estimates the radiation being delivered to a specific tumor and nearby tissue. Its modeling explicitly accounts for inhomogeneities in the body such as air, muscle, and bone that are identified on the patient's computed tomography (CT) scan.



We are partnering with BioLuminate Inc. to develop Smart Probe, a tool for detecting early breast cancer without biopsy. Sensors on the tip of the probe measure in real time the optical, electrical, and chemical properties that are known to differ between healthy and cancerous tissues. Physicians can then determine whether more tests are necessary.

Livermore researchers are developing technologies to carefully control the wavefront of 13.4-nanometer-wavelength light reflected by very precise mirrors. The shape of the wavefront must be accurate to 1 nanometer for EUV lithography to be able to produce next-generation silicon chips with features as small as 30 nanometers.